(i) a light beam source aligned to direct a light beam along the light path; and

(ii) a light beam detector configured to detect the light beam exiting the container and to produce a first signal when the light beam travels a direct path through the interior volume of the container when no gas pocket is present in the light path and a second signal when the light beam travels a refracted path through the interior volume of the container when a gas pocket is present in the electrolyte in the light path.

43. The electrochemical cell assembly of claim 42, wherein the light beam source is a laser.

A1 cont'd

44. The electrochemical cell of claim 42, wherein the wall is substantially clear.

45. The electrochemical cell of claim 42, wherein the container is cylindrical and has end portions, the wall is annular, and the anode and cathode are located adjacent to the end portions.

46. The electrochemical cell of claim 45, wherein the annular wall is substantially clear.

47. The electrochemical cell of claim 42, wherein the light beam detector is located in the refracted path and not in the direct path.

48. The electrochemical cell of claim 42, wherein the light beam detector is located in the direct path and not in the refracted path.

49. The electrochemical cell of claim 42, wherein the light beam detector is located in the direct path and a second light beam detector is located in the refracted path.

50. The electrochemical cell of claim 42, further comprising an alarm circuit in electrical communication with the gas pocket detection assembly to monitor the cell for the presence of a gas pocket in the light path.

51. A method for predicting failure of an electrochemical cell comprising a container having a wall defining an interior volume, the cell further comprising an anode and a cathode, comprising the steps of:

a) passing a light beam through a light path in the interior volume, wherein the light path passes through a portion of the interior volume of the container in which gas collects before or during failure of the electrochemical cell from loss of electrolyte from the interior volume; and

b) detecting differences in the path of the light beam with a light beam detector configured to detect the light beam exiting the container and to produce a first signal when the light beam travels a direct path through the interior volume of the container when no gas pocket is present in electrolyte in the light path and a second signal when the light beam travels a refracted path through the interior volume of the container when a gas pocket is present in electrolyte in the light path.

A1 cont'd

52. The method of claim 51, wherein the light beam source is a laser.

53. The method of claim 51, wherein the wall is substantially clear.

54. The method of claim 51, wherein the container is cylindrical and has end portions, the wall is annular, and the anode and the cathode are located adjacent to the end portions.

55. The method of claim 54, wherein the annular wall is substantially clear.

56. The method of claim 51, wherein the light beam detector is located in the refracted path and not in the direct path.

57. The method of claim 51, wherein the light beam detector is located in the direct path and not in the refracted path.

58. The method of claim 51, wherein the light beam detector is located in the direct path and a second light beam detector is located in the refracted path.

59. The method of claim 51, further comprising an alarm circuit in electrical communication with the gas pocket detection assembly to monitor the cell for one of formation and enlargement of a gas pocket in the container.

60. A method for detecting gas bubbles in an electrochemical cell that comprises a wall defining an internal volume, an anode, a cathode and an electrolyte within the internal volume, the method comprising the step of directing a light beam on a light path that passes through a portion of the interior volume where gas collects before or during failure of the electrochemical cell from loss of electrolyte from the interior volume and at one or more light beam detectors, wherein one or more light beam detectors are configured to produce a first signal when a gas pocket is located in the light path and a second signal when no gas pocket is located in the light path.

61. The method of claim 60, wherein the light beam is a laser beam.

62. The method of claim 60, wherein the electrochemical cell is a gas sensor.

A1 cont'd

63. The method of claim 60, wherein the electrochemical cell is an oxygen sensor.

64. A method for retrofitting an electrochemical gas sensor assembly comprising an electrochemical cell comprising a container having a wall defining an interior volume, an anode, a cathode and electrolyte within the interior volume, the container having a light path passing through the wall and a portion of the interior volume of the container in which gas collects before or during failure of the electrochemical cell from loss of electrolyte from the interior volume, the method comprising the step of attaching a gas pocket detection assembly to the gas sensor, the gas pocket detection assembly comprising:

(i) a light beam source aligned to direct a light beam along the light path; and

(ii) a light beam detector configured to detect the light beam exiting the container and to produce a first signal when the light beam travels a direct path through the interior volume of the container when no gas pocket is present in the light path and a second signal when the light beam travels a refracted path through the interior volume of the container when a gas pocket is present in the electrolyte in the light path.

65. An apparatus for retrofitting an electrochemical gas sensor device including an electrochemical cell comprising a container having a wall defining an

interior volume, an anode, a cathode and an electrolyte, the container having a light path passing through the wall and a portion of the interior volume of the container in which gas collects before or during failure of the electrochemical cell from loss of electrolyte from the interior volume, the apparatus comprising parts of a gas pocket detector assembly, the parts comprising:

(a) a light beam source;

(b) a light beam detector; and

(c) a bracket or brackets configured to:

(i) engage the light beam source and to position the light beam source to direct a light beam along the light path through the interior volume; and

(ii) engage a light beam detector and position the light beam detector to detect a light beam from the light beam source exiting the container from the interior volume so that the detector produces a first signal when the light beam travels a direct path through the interior volume of the container when no gas pocket in the electrolyte is located in the light path and a second signal when the light beam travels a refracted path through the interior volume when no gas pocket is present in the electrolyte in the light path.

A1 Cont'd

66. The apparatus of claim 65, wherein the light beam source is a laser.

67. The apparatus of claim 65, wherein the electrochemical cell is a gas sensor.

68. The apparatus of claim 67, wherein the electrochemical cell is an oxygen sensor.

69. The apparatus of claim 67, further comprising an electrochemical cell.

70. The apparatus of claim 67, further comprising computer software and/or hardware comprising an alarm circuit in electrical communication with the gas pocket detection assembly to monitor the cell for the presence of a gas pocket in the light path.

71. A bracket or set of brackets for retrofitting an electrochemical gas sensor device with a gas pocket detector including a light beam source and a light beam detector, the

electrochemical gas sensor including an electrochemical cell comprising a container having a wall defining an interior volume, an anode, a cathode and an electrolyte, the container having a light path passing through the wall and a portion of the interior volume of the container in which gas collects before or during failure of the electrochemical cell from loss of electrolyte from the interior volume, wherein the bracket or set of brackets are configured to engage one of the electrochemical gas sensor device and a housing therefor, and to:

A1 cont'd

(i) engage the light beam source and position the light beam source to direct a light beam along the light path through the interior volume; and

(ii) engage a light beam detector and position the light beam detector to detect a light beam from the light beam source exiting the container from the interior volume so that the detector produces a first signal when the light beam travels a direct path through the interior volume of the container when no gas pocket in the electrolyte is located in the light path and a second signal when the light beam travels a refracted path through the interior volume when no gas pocket is present in the electrolyte in the light path.

REMARKS

Claims 1-41 are pending. Claims 1-41 are hereby cancelled in favor of new claims 42-71. No new matter is added by the submission of these claims.

The Examiner has rejected claims 1-41 under 35 U.S.C. §§ 102 (b) and/or 103(a) for anticipation by or obviousness for the reasons stated on pages 2-7 of the Action. In view of the amendments presented herein, in which the claimed subject matter is limited to optical detection of gas pockets in electrochemical cells, many of the rejections are rendered moot because the claims now do not read on the use of electrical circuits to detect liquid levels in the electrochemical cells. Applicants hereby address the individual rejections pertaining to the use of a light beam to detect gas pockets in electrochemical cells, that is, the rejections of original claims 5-12, 18-25, 27-30 and 33-41.